On the performance of a nanocatalyst-based direct ammonia alkaline fuel cell (DAAFC) under microgravity conditions for water reclamation and energy applications.

Problem Statement

- The test of a direct ammonia alkaline fuel cell (DAAFC) is directed towards optimizing the Electrochemical Ammonia Reduction (EAR) subsystem, critical to the Forward Osmosis Secondary Treatment (FOST) system. This project is covered by the Office of the Chief Technologist Next Generation Life Support project.

- In previous research by Micro-G CANM1& 2 the electrochemical oxidation of ammonia in microgravity using different nano- materials led to 20-65% decrease in the catalytic current. This flight opportunity is to microgravity adapted catalysts in an operating fuel cell hardware under microgravity conditions. Matured technology has applications to the water reclamation and energy production community.

Technology Development Team

Principle Investigators: Dr. Carlos Cabrera,University of Puerto Rico (UPR), carlos.cabrera2@upr.edu; Michael Flynn, NASA Ames. Dr. Eduardo Nicolau (UPR) and Dr. Harry Rivera (UPR)

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Proposed Flight Experiment

Experiment Readiness: Experiment will be ready for flight for the FY 2013 campaign.

Test Vehicles: Parabolic Flight

Test Environment: The equipment flew on June 2011 via the 2011 NASA Microgravity University / Minority Institution Flight Week Program (Proposal Number 2011-25329) and approved to flight via proposal NOCT110 Call #3 last September 2012.

Test Apparatus Description: The Electrochemical Microgravity Laboratory (EML) is comprised of 2 major components: (a) Electronics Rack (ELR) to control the electrochemical operation and (b) Experimental Equipment Box (EEB) double contained Makrolon™ box safely containing the electrochemical cells (triple containment in overall).

Electronics Rack | Experiment Equipment Box

Technology Maturation

- The proposed research is TRL 6.

- DAAFC prototype demonstration in a microgravity environment is imperative. The performance of the DAAFC is critical to EAR correct sizing and integration to the FOST system. The EAR has delivery date of Jun 2013. Without this flight opportunity on FY 2013 this milestone can be hampered

Objective of Proposed Experiment

Objectives: Test the performance of a DAAFC under microgravity conditions by: (1) determining optimized operating conditions; (2) by employing different microgravity adapted nanocatalysts that are selective towards the electrochemical oxidation of ammonia.

Environmental Control and Life Support Systems (ECLSS) and Habitation Systems - Water Recovery and Management